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UNITED STATES DEPARTMENT OF AGRICULTURE

BULLETIN No. 636

OFFICE OF THE SECRETARY

Contribution from the Office of Farm Management, W. J. SPILLMAN, Chief
(In cooperation with the Office of Horticultural and Pomological Investigations)

Washington, D. C. ▼ May 10, 1918

COST OF PRODUCTION OF APPLES IN THE PAYETTE VALLEY, IDAHO

A DETAILED STUDY OF THE CURRENT COST FACTORS INVOLVED IN THE MAINTENANCE OF ORCHARDS AND THE HANDLING OF THE CROP ON 38 REPRESENTATIVE BEARING ORCHARDS, PAYETTE DISTRICT IN WESTERN IDAHO

By

S. M. THOMSON, Scientific Assistant
G. H. MILLER, Assistant Agriculturist

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COST OF PRODUCTION OF APPLES IN THE PAYETTE VALLEY, IDAHO.

A detailed study of the current cost factors involved in the maintenance of orchards and the handling of the crop on 38 representative bearing orchards, Payette district in western Idaho.

By S. M. THOMSON, *Scientific Assistant*, and G. H. MILLER, *Assistant Agriculturist*.

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The cost studies upon which this bulletin is based were made during the year 1915 in an intensive commercial apple district in the vicinity of Payette, Idaho (see Fig. 1). The number of commercial apple orchards of bearing age in this region was very limited, so that but 38 detailed and accurate records could be obtained. These are typical of the region, however, and present data which fairly illustrate apple-growing conditions in this region.

SUMMARY OF RESULTS.

Following is a brief résumé of the more important averages brought out by this study:

Size of 38 farms studied, 53.39 acres.
Size of bearing apple orchard, 11.33 acres.
Investment per farm, $20,689.62.
Investment per acre of bearing apples, $613.16.
Trees per acre, 63.34.
Annual yield per acre, 337 boxes.
Net labor costs, $103.40 per acre, $0.3068 per box (43.14 per cent of total annual net cost of production).
All other costs, $136.25 per acre, $0.4043 per box (56.86 per cent of total annual net cost of production).
Total annual net cost of production, $0.7111 per box.

NOTE.—Acknowledgment is due to the Office of Horticultural and Pomological Investigations of the Bureau of Plant Industry for material assistance in the preparation of this bulletin; also to Mr. J. Clifford Folger, who aided in securing the necessary data.

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In the light of the facts developed the following conclusions have been drawn as to the business of the farms studied:

The stability of the agriculture of these farms is due to the fact that, in the main, they have been developed along more or less diversified lines.

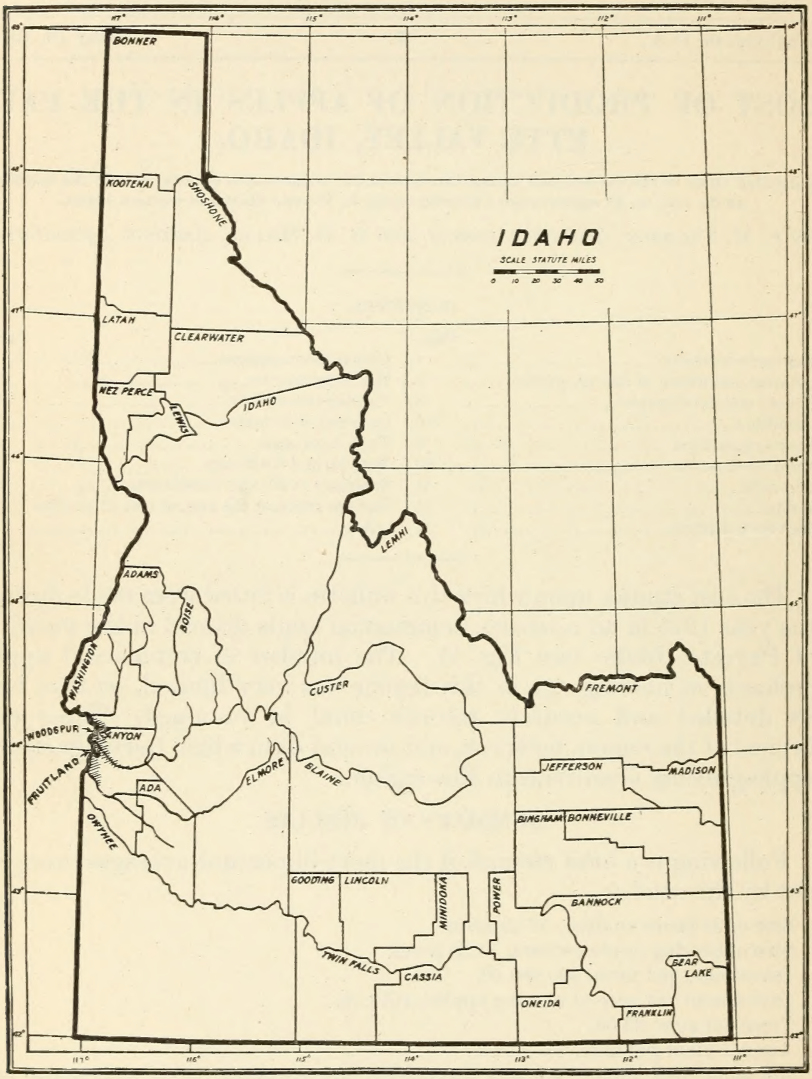

FIG. 1.—Map showing the State of Idaho and the location of the Payette fruit region.

Although the specialized fruit ranches may be the more successful in some years, the general and more diversified farms are the more successful on the average of a series of years.

Both average price and average cost of production for the region are kept below the level of those of many other apple-growing regions by the presence of a number of poorly cared for orchards producing low-grade apples.

Proper soil, good drainage, and a site not subject to frost danger are essential to the success of the apple industry on these farms.

Investment in land, yield, quality of fruit, soil, climate, and price received for fruit are all important limiting factors in the production of fruit and should be considered carefully by the present or prospective fruit grower.

Though these conclusions are advanced as applying only to the 38 farms studied, it is believed that they will apply in large measure to the Payette fruit region as a whole.

LOCATION AND EXTENT OF DISTRICT STUDIED.

The Payette, apple-growing section is located near Snake River, in the extreme northwestern part of Canyon County, on the Oregon Short Line Railway. Canyon County is in western Idaho, about 150 miles north of the Nevada line. (See fig. 2.) The elevation at Payette is 2,159 feet. This is a very extensive region, the limits of which are not well defined, as fruit growing is scattered the length of the Payette Valley and also follows the Snake and Boise River valleys. The most intensive of the bearing-orchard sections, however, is located in what is known as the Fruitland district, which is a triangular bench lying between the Payette and Snake Rivers, including about 25,000 acres of irrigated land. (See Pl. I.)

Only a small portion of the bench land is devoted to fruit. Hay and grain farming is the prevailing type, and considerable live stock is raised. (See fig. 3.) The principal shipping stations are Fruitland, a station about 5 miles south of Payette, and New Plymouth, a station 12 miles southeast of Payette. The elevation of Fruitland is about 2,200 feet. The entire bench is comparatively flat, rising from the rivers on either side and forming a broad, level table. From where the Payette River empties into the Snake River, fruit continues along the east bank of that river, in scattered areas, as far north as Weiser, a distance of about 18 miles from Payette. Other shipping stations are Emmett, Parma, and Woodspur.

The estimated extent of orchard acreage in the Payette district is approximately 20,000 acres, of which 90 per cent is in apples. Prune plantings take up most of the remaining acreage. The greater part of the apple acreage has not yet come into bearing. Pears, cherries, peaches, and berries are grown only to a limited extent.

As this region is located a long way from the centers of distribution, the transportation problem is an important one. Thus the location has had much to do with the development of the type of agriculture, and many farmers have found it more profitable to feed their grain and hay to stock than to ship bulky products to distant markets.

HISTORY AND DEVELOPMENT.

The Payette Valley is an old settled region. A few ranches were taken up as early as 1849, but it was not until after 1884, when the railroad came in, that the development of the district was marked.

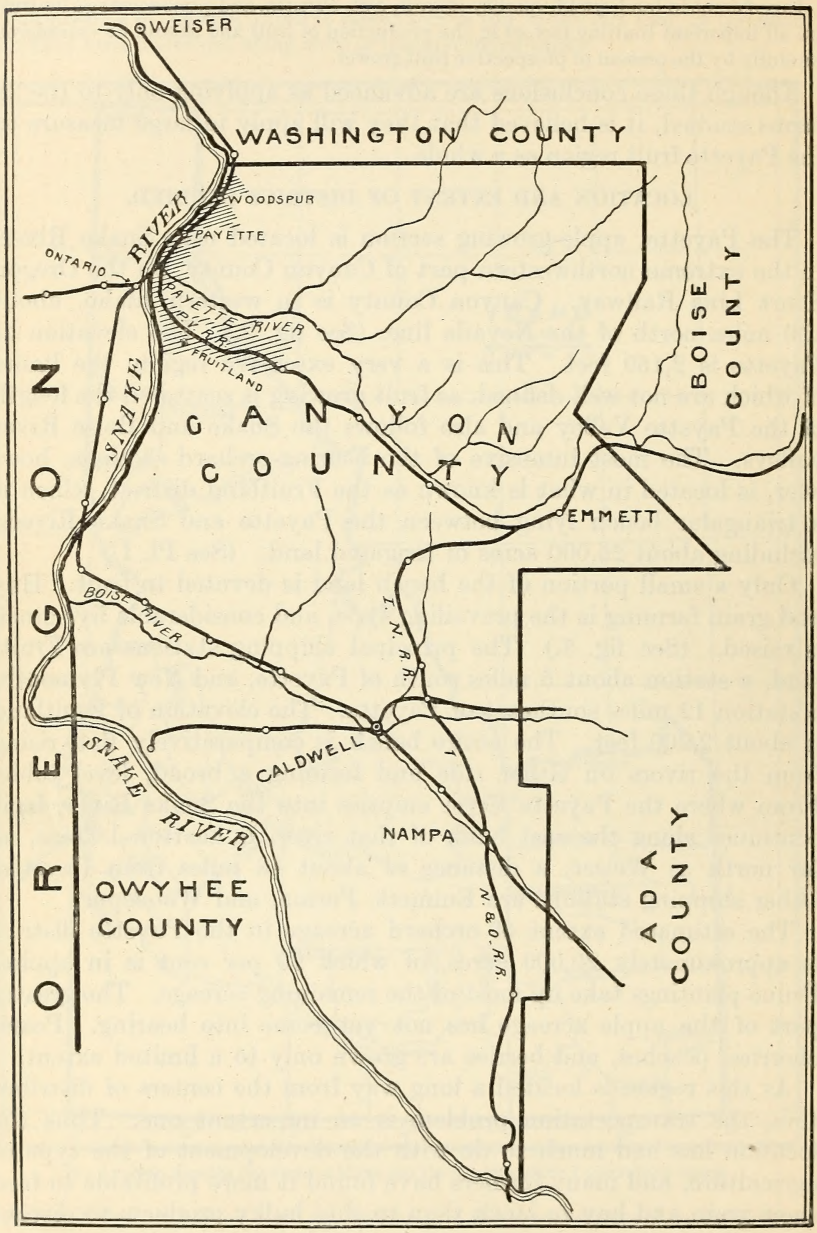

FIG. 2.—Map of Canyon County, showing the most intensive fruit area of that section.

In 1881 the first irrigation project was started. (See Pl. II.) Prior to this time the farming industry was confined largely to raising horses and cattle and growing grain for home consumption.

The history of the orchard industry in the Payette region dates from the early eighties, but it was not until about 1895 that commercial plantings of prunes and apples were made. Most of the planting has been done since 1900. During the last four or five years the planting of apples has fallen off, but prunes still are being planted in commercial quantities.

The early orchards were largely home orchards and were made up of many varieties, including Wolf River, Lawver, Ben Davis, Baldwin, and many other old varieties. The later orchards are made up largely of Jonathan and Winesap, which are the principal commercial varieties of the valley to-day. Mining towns, such as Butte

FIG. 3.—A small ranch near Fruitland showing the type of diversified farming practiced.

and Anaconda, together with the smaller settlements located nearer Payette, offered the best markets for the products of the valley in early years, but with a growth of the industry more distant markets were sought.

Many of the owners of the older bearing orchards are those who bought the land at comparatively low prices and developed it themselves. Homesteads could have been taken up in the valley as late as 1895. Much of the younger acreage of apples and a few of the older tracts are held by a class of newcomers who have settled in the valley during the last few years. Owing to frosts and occasional years of poor prices, many growers have been disappointed somewhat in the apple industry. Taking into consideration the agricultural experience of the region, it would seem that specialized fruit growing does not promise to become relatively as important as in some regions which by virtue of their location, soil, and climate are better adapted to the production of high-grade apples.

CONDITIONS.

LABOR CONDITIONS.

Labor conditions in the valley, generally speaking, are very good. Month help is often employed with an addition of day help during harvesting. The average labor rate is somewhat less than in the specialized northwest fruit districts, where labor is largely dependent on fruit, with little general farming to fill in the gaps between the busy seasons. Here labor can find employment for the entire year on account of the great diversity and kinds of farming followed. Grain, hay, stock, and fruit under both intensive and extensive types of farming are found.

At the time of this survey the labor rate on the farms studied was $0.20 per hour for man labor and $0.15 per hour for horse labor. The horse-labor rate is figured on the basis of the value of team labor where one grower works for another and is perhaps higher than would be the actual cost of keeping a team. However, in the case of the fruit ranchers so many of the farms are specialized that profitable employment for these teams throughout the season can not be depended on, as on the large diversified farms. Thus $0.15 per hour, although apparently a rate comparatively higher than the man-hour rate, is really a fair rate, all things being considered. It is necessary to keep horses on these ranches. Man labor is at all times present in the community, and its rate is determined by the community, while the rate of the horse labor is determined by the size and type of farm on which the orchards are located.

SOCIAL CONDITIONS.

The social conditions are all that could be desired. There are excellent schools and churches within easy access of most parts of the valley, and farmers' social organizations flourish. The type of farm is generally extensive enough so that the children remain in the community and help build it up. The farmers as a class come very largely from the same walk of life and thus are able to understand and cooperate with each other more or less on a common basis.

Such modern rural improvements as mail service, telephones, etc., are found throughout the region.

TRANSPORTATION.

This district is somewhat at a disadvantage in being a long way from the centers of distribution. This disadvantage is most marked in the case of the fruit industry, for fruit, especially soft fruit, is a highly perishable product.

The Payette Valley Railway traverses the Payette Valley and connects with the Oregon Short Line Railway. The town of Payette is located on the main line of the Oregon Short Line. The shipping facilities from here are good, but some idea of the distance from the

nearer large cities may be obtained from the fact that Payette is 462 miles from Salt Lake City, Utah, and 460 miles from Spokane, Wash.

In early years much of the fruit was disposed of in the local markets, especially in the mining towns and the small cities of Idaho. However, with the increased production in other parts of the State it was necessary to find an outlet into the large trade channels of the country.

SOIL.[1]

The soils in the parts of Payette Valley where fruit is grown are of various types. The prevailing type is a sandy loam varying greatly in texture and depth in different parts of the valley. Most of the soil along the Payette River is of an alluvial nature. The river bank is comparatively low, but the lands are not generally subject to overflow. The sandy-loam type of soil, found on the bench and higher cultivated lands on which much of the best fruit is located, varies from 2 to 4 feet in depth, and the subsoil is permeable to water. Crops of all kinds apparently do well on this type of soil. There are some types found in which the surface soil is the sandy loam, a few inches in depth, shading into the clay loam at a depth of about 2 feet. Much of this loam area is underlain with hardpan.

The sandy-loam type of soil found about Fruitland seems especially adapted to fruit culture. Much of this region is believed to have been formerly a large fresh-water lake, the soil being composed in many places of very thick sedimentary deposits. This region also is formed largely of volcanic material. Much of the soil contains a considerable percentage of soluble salts, and alkali often appears on the surface after irrigation.

CLIMATE.

The climate of the Payette and Snake River Valleys is arid to semiarid. It is characterized by little precipitation, a relatively low humidity, moderate temperature, abundance of sunshine, clear air, and slow wind movement. The annual precipitation is much greater in the mountains than upon the lower lands. This region is dependent upon the mountain snows formed during the winter for its supply of water for irrigation during the summer. Low water or a lack of water for sufficient irrigation is due to a relatively light snowfall the preceding winter. The mean annual temperature for Payette is about 50° F. The maximum temperature during the past 15 years was 111° F. on July 23, 1905, and the minimum for the same period was −26° F. on January 26, 1910. Table I shows these temperatures, together with the dates of the last killing frost in the spring and the first in the autumn. Late frosts are not uncommon throughout this region, and they often cause considerable damage and render the fruit crop uncertain. Hailstorms also sometimes occur. However, the damage from hail is usually much less than in fruit regions at higher altitudes.

[1] Soil survey of the Boise area, Idaho (Field Operations, Bureau of Soils, 1901).

TABLE I.—*Dates of spring and fall frosts, annual rainfall, and mean annual temperature at Payette, Idaho.*

[Altitude, 2,159 feet.]

Year.	Last frost in spring.	First frost in fall.	Annual precipitation.	Annual temperature.	Highest temperature.		Lowest temperature.	
					Degrees.	Date.	Degrees.	Date.
1900	Apr. 13	Sept. 25	10.60	53.7	104	July 30	10	Dec. 31
1901	June 4	Oct. 16	13.50	53.3	106	July 23	5	Feb. 8
1902	May 1	Sept. 16	14.04	51.2	102	June 23	−13	Jan. 28
1903[a]								
1904	June 23	Oct. 16	18	52.1	107	Aug. 13	− 3	Jan. 4
1905	May 21	Oct. 8	8.86	51.2	111	July 23	− 2	Feb. 11
1906[a]								
1907	May 2	Sept. 14	9.95	51.3	103	Aug. 1	− 1	Jan. 16
1908	Apr. 29	Sept. 26	7.52	50.7	108	July 31	5	Feb. 1
1909	May 17	Sept. 18	10	50.6	104	July 22	− 2	Dec. 28
1910	Apr. 6	Sept. 29	10.38	50.1	107	July 13	−26	Jan. 3
1911	Apr. 16	Sept. 26	9.74	48.9	104	July 17	− 3	Dec. 21
1912	May 18	Sept. 16	13.15	48.4	101	...do.....	−23	Jan. 8
1913	May 17	Sept. 18	14.26	48.9	102	Aug. 24	− 7	Jan. 6
1914	June 5	Oct. 24	5.90	50.3	103	Aug. 14	− 8	Dec. 8
1915	May 4	Sept. 14	9.67	50.9	103	July 22	− 5	Dec. 30
Average (14 years)	May 10	Sept. 28	11.11	50.8	104.6	July 29	− 5.2	Jan. 10

[a] Data incomplete.

FARM ORGANIZATION.

The Payette Valley is a comparatively old and established farming section. It is one of general farming, although fruit occupies an

FIG. 4.—A large alfalfa field near Payette at the time of harvesting the third crop. Alfalfa often yields 8 tons per acre in this region.

important place in its agriculture. (See fig. 3.) The fruit areas are limited and for the most part are located near a few shipping stations. The average size of the farms included in this investigation

THE SNAKE RIVER NEAR PAYETTE, SHOWING THE BENCH-LAND FORMATION AND BROAD STRETCHES OF BOTH ARID AND IRRIGATED LAND.

AN IRRIGATION DITCH IN THE PAYETTE REGION.

Note the orchards bordering on either side.

is 53.39 acres, with 11.33 acres in bearing apples. This is a much higher percentage of orchard land than would be found by taking all the farms in the valley. The farms about Fruitland are very largely specialized fruit farms, and in many cases the acreage is made up wholly of fruit. In the somewhat outlying districts, which were settled more recently and irrigated, the type of agriculture is much more general.

The community as a whole may be considered a staple farming community, as there are enough of various farming enterprises to insure the success of at least a portion of the ranchers each year. Dairy farms, of which there are a number in this region, are organ-

FIG. 5.—A farmstead scene on one of the higher bench lands. Owing to difficulty in irrigating and the high cost of water, some of these settlers have had to economize in order to retain their land.

ized on the basis of raising all the feed to be used on the place. On most of the dairy farms considerable hay and grain are sold. (See fig. 4.) Nearly all the fruit growers keep at least some stock, those with mulch-crop orchards keeping the greater number. Nearly every rancher raises hogs for home use and several for sale. The growers also raise garden truck, potatoes, etc., for home use, so that the farm contributes a very large percentage of the products used by the occupants.

Tributary to this region are large stock-grazing areas. Much of the land recently irrigated is devoted to raising alfalfa. (See fig. 5.) Raising clover and alfalfa seed is also an important and profitable branch of farming found here. As might be expected, the more intensive type of farming is found near the towns, where the fruit

is handled by local warehouses and associations without necessitating any long haul.

In speaking of Payette Valley and Canyon County area as a region it may be considered as representing a very successful and diversified type of agriculture. However, the farms studied are all fruit ranches, for the most part somewhat specialized. The orchards on those which are not specialized show more or less a lack of care. Especially is this true of the large ranches where cattle are kept.

The men found on these ranches are for the most part farmers; that is to say, they are not men from other professions who have selected farming and apple growing as a means of retiring from active life, as have so many residents of other fruit sections of the Northwest. These men did not expect unusual prices or crops, and with land at a reasonable figure they have been able to build up a stable business. There are of course some ranchers who located on sections hard to irrigate, and who, caught in years of low prices with little working capital, have lost out.

In general, the ranchers are intelligent and progressive and willing to adopt new ideas and to apply them to conditious. They are practical men of limited capital who tend to develop their farming along more conservative lines than one finds in certain regions where speculators have been responsible for the development.

FARM INVESTMENTS.

The average total investment per farm in the case of the 38 ranches for which data were obtained is $20,689.62, the average size of farm is 53.39 acres, and the investment per acre of apple orchard averages $613.16.[1]

Table II shows the comparative investments on the clean-cultural and mulch-crop orchards. The machinery equipment investment on the farms studied ($542.63 per farm) represents present value of equipment. It may be stated, however, that the equipment on these farms is generally in fairly good condition, much of it being comparatively new.

As might be expected, the mulch-crop orchards show the greatest investment in stock other than horses. Hogs often are pastured on the alfalfa orchards.

[1] In all these investment figures each farm is given the same weight on an acre basis.

TABLE II.—*Size of farms and of investments for farms studied in the Payette region, Idaho.*

Item.	System of orchard management on farm.		All records.
	Clean-cultural.	Mulch-crop.	
Number of records	16	22	38
Average size farm (acres)	60.05	48.55	53.39
Investment per farm:			
Total	$22,324.28	$19,500.77	$20,689.62
In land and improvements	$20,697.66	$17,818.18	$19,030.59
In equipment	$531.25	$550.91	$542.63
Average size orchard (acres)	13.56	9.70	11.33
Per cent of farm in orchard	33.65	37.88	36.10
Investment per acre of orchard:			
Total	$581.25	$636.36	$613.16
In equipment	$16.94	$23.09	$20.50
Per cent of total farm investment apple orchard represents	38.27	36.34	37.16
Per cent of land and improvement investment apple orchard represents	41.59	39.80	40.55
Number of horses per farm	4.19	3.50	3.79
Investment in other stock per farm	$496.00	$666.41	$594.66

The investment in farm land on the farms studied in the Payette region determines to a great degree the success of the farmer. In the earlier years settlers bought or homesteaded land and developed it gradually, thus acquiring the land at a much lower price than did the later settlers, who usually bought from real estate companies and paid much of their capital down on the land. For this reason many of these men who came from other parts and paid $300 to $500 and often more per acre for some of this land found themselves unable to compete with those who had acquired land at a much lower figure. Thus, in years of bad fruit prices and general poor crops men with little means of marketing their produce without an actual loss have not been able to succeed. Others are having trouble in meeting the interest payments on the heavy mortgages which they carry.

ORCHARDS.

SIZE AND TYPE.

The apple orchards in the valley differ greatly in size, but those studied average 11.33 acres. The 16 clean-cultural orchards average 13.56 acres, and the 22 mulch crop, 9.70 acres. These orchards vary in their general condition and in the number of trees per acre. Many of them are more or less neglected, and some are on soil not well adapted to fruit culture. Others are located in regions liable to frost.

The poorest orchards are those in alfalfa and bluegrass which have been down for a number of years and have been cut off or pastured annually by stock and never returned to the land. There is a tendency to neglect the older orchards, especially as regards soil management.

AGE OF ORCHARD.

The orchards in the Fruitland and Woodspur districts near Payette average nearly 15 years in age. There were many early plantings, but these were confined to very limited areas. Some of the older orchards are found in the vicinity of New Plymouth, but they are scattered widely. Many of the older orchards are neglected.

INVESTMENT IN ORCHARDS.

The average investment per acre in the orchards of the Payette district is much less than that of some other fruit regions. (See Table II.) This is due to the fact that Payette Valley is not as favorably located as some other regions in regard to transportation and is in a general farming region which has been developed along nonspeculative lines.

FIG. 6.—A 5-year-old Delicious orchard near Boise. Note the habit of growth and size of these trees. This grower believes in little pruning for young trees of this sort.

The average investment in bearing apple orchards is $613.16 per acre, and the average equipment investment is $20.50 per acre. This includes only machinery and orchard equipment. The bearing apple orchard represents 37.16 per cent of the total farm investment and 40.55 per cent of the total land and improvement investment. There is a comparatively small acreage of young apples not yet in bearing on these 38 farms, and few apples are now being planted. There is, however, a large acreage in other fruits, especially prunes.

VARIETIES.

Many varieties of apples are grown commercially in the Payette Valley, but the leading of these is the Jonathan, which usually brings a good price but has the disadvantage of being susceptible to blight and mildew. This is followed by the Winesap. Others of commercial importance are the Rome Beauty, Ben Davis, and Arkansas Black. Varieties that formerly were planted very

extensively and that are now found largely in the older orchards are Baldwin, Wealthy, Wolf River, Lawver, Arkansas, Missouri, York Imperial, and many fall varieties. There are a few varieties which are found in smaller numbers but which are popular commercially. Among these are White Pearmain, Delicious, and Stayman Winesap. The Ben Davis, although found in many orchards throughout the valley, is no longer being planted and is seldom found in orchards under 10 years of age. (See fig. 6.)

METHOD OF SETTING.

The trees are set by various methods. Usually either the square or diagonal method is used. A popular distance is 28 by 28 feet on the diagonal, but the older orchards are set by all methods, and the trees are all distances apart. The trees per acre vary between the limits of 50 and 90, the average for the farms studied being 63.

YIELDS.

The yields of the orchards studied in Payette Valley are fairly uniform. In arriving at these results the yield was secured for a period of five years, including seasons of both light and heavy yields, thus giving a fair average. It was found that in the case of the clean-cultural orchards there is a yield of 336 packed boxes per acre and in the mulch-crop orchards a yield of 338 per acre, making 5.7 boxes per tree in the clean and 5.1 boxes in the mulch crop, there being about eight more trees per acre in the mulch-crop orchards. (See Table III.)

Many factors influence the yield—the number of trees per acre, the variety, size, and age of trees, size of orchard, the amount of pruning, thinning, and propping practiced, the percentage of marketable fruit, etc. Generally speaking, the smaller the orchard the larger the yield per acre. On account of the relatively small number of orchards which were available in this region, no definite conclusions can be reached in this regard.

TABLE III.—*Packed-box yields on farms studied in Payette Valley, Idaho.*

Orchard management.	Number of orchards.	Size of orchard.	Age of orchard.	Trees per acre.	Yield per acre.	Yield per tree.
		Acres.	*Years.*		*Packed boxes.*	*Packed boxes.*
Clean-cultural	16	13.56	14.25	58.6	336	5.7
Mulch-crop	22	9.70	15.18	66.8	338	5.1
All orchards	38	11.33	14.79	63.3	337	5.3

The age of the orchard has little apparent effect on the yield after the trees reach 10 years of age. The Jonathan variety comes into bearing at a comparatively early age, as does also the Winesap.

In addition to the packed-box yield of 337 boxes for all orchards studied, there is also a considerable yield of culled fruit, which is not considered in the discussion of yields, though credited to the orchard.

MARKETS AND PRICES.

The apples of the Payette Valley and the immediate region have of late years returned the grower varying prices per box f. o. b. shipping station. The average price received by these 38 growers was $1.06 per packed box in 1910, $0.95 in 1911, $0.62 in 1912, $1.02 in 1913, and $0.37 in 1914, or an average for the five years of $0.804. The average annual cost of production per box, considering the average yield over these five years, is $0.7111. In cases of low prices there is generally a higher yield, and consequently the cost of production is reduced somewhat for that year. However, in 1912 and 1914 the cost of production was greater than the price received for fruit. These figures refer to the price for packed fruit received by the grower f. o. b. shipping point. Only on general farms and in the case of men with considerable working capital, can growers weather years with such disastrous fruit prices as those of the year 1914.

The fruit in this region is marketed in three grades—extra fancy, fancy, and C grade—as is done in some other regions of the Northwest. The growers have had many difficult marketing problems to face, in common with other Northwest regions.

ORCHARD MANAGEMENT.

MANURING.

Manuring is practiced by 63 per cent, or 24 out of the 38 growers. In the case of the Jonathan orchards some growers do not apply manure, for the stated reason that it stimulates wood growth. The prevalence of fire blight and its activity in rapidly growing trees account for their caution in this regard.

Manure usually is applied from a wagon, one man and two horses forming the crew. Application is made generally during the spring or fall or, in some cases, as the manure accumulates. The rate of application is variable, ranging from 5 to 15 tons per acre. Table IV will serve to show the manuring practices and costs.

TABLE IV.—*Relation between manuring practices and costs of apple production on farms studied in Payette Valley, Idaho.*

Orchard management.	Number of farms.	Per acre.						Total cost per box.
		Man hours.	Horse hours.	Cost of labor.	Tons of manure.	Material cost.	Total cost.	
Clean-cultural	11	5.19	9.90	$2.52	5.99	$8.98	$11.50	$0.0342
Mulch-crop	13	6.67	13.04	3.29	6.68	10.02	13.31	.0394
All records	24	5.96	11.60	2.94	6.36	9.54	12.48	.0370
All records, pro rata [a]	38	3.78	7.32	1.85	4.02	6.03	7.88	.0234

[a] In this line appear the averages derived by distributing the cost of manuring over all the farms surveyed in order to secure a figure that legitimately can be used in figuring the regional cost of apple production.

It is found that more manure is applied annually per acre on orchards in mulch crop than on clean-cultural orchards. This is partly due to the fact that the mulch-crop orchards are smaller, thus making more manure available per acre, and partly to the fact that the farms which have orchards in mulch crop keep about one-third more stock than those which have the clean-cultural orchards. It is found that the labor cost for manuring is 1.79 per cent of the total net labor cost, while the material cost is 4.43 per cent of the total material and fixed cost, making the total cost of manuring 3.28 per cent of the annual net cost of production.

PRUNING.

Pruning is practiced generally every year by all growers. The open-head tree system is the most popular form of pruning, and from four to seven leaders with a well-opened head is the type sought. As

FIG. 7.—A young orchard near Payette from which alfalfa has been harvested. Note the flock of 700 turkeys. A great diversity of live stock is profitably raised in this section.

the principal variety of the Payette Valley is the Jonathan, it is necessary to give the tree plenty of light in order to give color to the fruit. There is no noticeable tendency as yet to head back the tops of the trees in order to keep their height reduced. (See fig. 7.) The cost of pruning is $0.15 per tree, or $0.0281 per box. This, as will be seen (Table V), is identical with the cost of thinning for all the orchards.

The pruning cost is somewhat higher for mulch-crop orchards than for clean-cultivated orchards. This, no doubt, is partly due to the fact that the average acreage of the mulch-crop orchards is about 4 acres less than that of those under the clean-cultural system, thus offering opportunity for more detailed care per acre. Pruning costs make up 9.16 per cent of the total net labor costs and 3.95 per cent of the total annual net cost of production.

HAULING BRUSH.

The growers in this region usually make a practice of trimming out the brush after it is pruned from the trees and saving the larger limbs for fuel. As there is a scarcity of native timber in this region, firewood is valuable, being priced at $4 to $5 per cord. The smaller brush is thrown on a sled or wagon and hauled to a convenient place for burning.

Considering all records, there is found to be a credit of $0.58 per acre annually for wood and a charge of $3.45 per acre, or $0.0103 per box, for the hauling and disposal of brush. This makes up 3.36 per cent of the net labor cost, or 1.45 per cent of the total annual net cost of production. Where only one or two cords are obtained from the orchard each year, the labor of trimming out the heavy wood for fuel represents almost the value of the wood.

THINNING.

Thinning is practiced generally throughout the valley. The work usually is done by day labor at the rate of $2 per day. As in other regions, thinning is practiced either by pulling the apples from the trees or by using thinning shears. The growers have many ideas as to the value of thinning. Some claim that excessive thinning of Jonathans tends to increase the apples in size and consequently to increase the liability of breaking down in storage. It is thought by many that the average-sized apple has somewhat better keeping qualities than the very large one. No definite statement can be made in regard to this question from the data at hand.

In the Payette Valley pruning and thinning are done to such an extent that the necessity for propping is obviated largely. Thinning usually is done during the early part of the season, preferably in June. There is found to be an average for those who thin of 48.64 man-hours per acre, or a cost of $0.154 per tree; but when this is distributed among all records there are 47.36 man-hours, or $9.47 annual labor charge per acre. This is a cost of $0.15 per tree, $0.0281 per box, or 9.16 per cent of the total net labor cost. The cost for thinning in the valley when prorated among all records is identical with the cost of pruning. (See Table V.)

TABLE V.—*Average time and cost of pruning, thinning, and propping for farms studied in Payette Valley, Idaho.*

Operation.	Per cent of growers practicing.	Man-hours.	Horse-hours.	Cost.		
				Per acre.	Per tree.	Per box.
Pruning	100.00	47.41	.....	$9.48	$0.150	$0.0281
Thinning	97.37	48.64	.....	9.73	.154	.0289
Propping	78.95	7.60	10.32	3.07	.048	.0091

TABLE VI.—*Pruning, thinning, and propping costs when prorated over all orchards studied in Payette Valley, Idaho.*

Operation.	Per cent of growers practicing.	Man-hours.	Horse-hours.	Cost.		
				Per acre.	Per tree.	Per box.
Pruning	100.00	47.41	.....	$9.48	$0.150	$0.0281
Thinning	97.37	47.36	.....	9.47	.150	.0281
Propping	78.95	6.00	8.15	2.42	.038	.0072

PROPPING.

Propping is not practiced so generally in the Payette region as in many other apple regions. It is found that practically 79 per cent of the growers prop. Where propping is not practiced at all it is the general rule for the growers to lighten the limbs by careful thinning and thus avoid the breaking down of the trees laden with fruit. Most growers haul out and set up props in a single operation, a wagon or truck being drawn by two horses, with one or two men to complete the crew. The cost of tending the props after being set up is very little. Board props are used almost exclusively, although a few growers use poles. These board props are usually 1 inch in thickness and vary in width from 2½ inches to 4 inches. These props usually can be bought for about $16 per thousand board feet. The length varies from 8 to 14 feet, and the boards usually are notched or cleated at the top. The propping cost ($3.07 per acre) is not quite one-third of the pruning or thinning cost and is 2.35 per cent of the total net labor cost, or practically 1 per cent of the total annual net cost of production. (See Table V.)

SOIL MANAGEMENT.

There are two distinct types of soil management in the valley, the clean cultural and the mulch crop. The mulch-crop system of management as practiced in the valley is largely one of keeping the orchard in sod for a period of years, so that, properly speaking, it receives very little benefit from a leguminous mulch crop. Some of these orchards are in bluegrass, but all are classed as mulch-crop orchards, as they are under the same general system of management. Sixteen of the 38 orchards are under the clean-cultural and 22 under the mulch-crop system. The average annual cost of plowing and cultivating on the former is $9.37 per acre, while in the case of the latter it is $2.72.

The system of soil management practiced is the most important factor influencing the health of the tree and the general producing capacity of the orchard.

The soil in the orchards of the valley apparently has not yet been depleted by clean cultivation, as has the soil of certain other regions. The growers seem to realize that humus is necessary for the soil and have applied considerable manure, thus lessening the necessity of returning humus to the soil in other ways. If this mulch cropping were practiced with a view to aiding the orchard and handled accordingly, the results no doubt would be different, but many of the larger and older orchards are down in mulch crop which has been there many years and is practically sod.

A few orchardists turn under their mulch crops from time to time, and one of the most successful orchardists in the valley alternates the mulch-crop and clean-cultural system every year. To a great extent the grower himself can determine from the health and vigor of his own orchard which type of soil management he should follow, and a combination of both systems would seem to be best as far as the orchard itself is concerned, but perhaps not the most profitable when the pasture and hay value of the crop on the orchard is taken into consideration.

CULTIVATION.

All the orchards in the valley have at least a small annual charge for cultivation. The least charge appears on those orchards which are in bluegrass for permanent pasture, in which case only occasional rills for irrigating are made, or sometimes the orchard may be disked, or harrowed with the spring tooth. (See Table VII.)

In regard to plowing, it was found that 12 (nearly 32 per cent) practice it, plowing on an average of 1.38 acres a day. The cost is $3.61 per acre for those who plow. (See Table VII.) Considering all orchards under both kinds of management, the acre charge for plowing is $0.85, and the box cost $0.0025.

Twenty-two (nearly 58 per cent) of the orchardists disk, the 7-foot riding disk being used ordinarily. This disking is done usually in the early spring and often prior to any other operation on the soil. A comparatively small percentage of the growers use the spring-tooth harrow. The spike-tooth harrow is used by 15 (nearly 40 per cent) of the orchardists. Various other implements are used on a few orchards.

Cultivation begins as a rule during the latter part of March or shortly after. Plowing is often the first operation in the spring. Some growers use either spring or spike tooth harrow for the first operation and follow this with a disk in order to loosen up the soil. Later in the spring, after the weeds have started, the disk may be used again, either one or both ways, and then followed by the spike or spring tooth harrow before the first irrigation. Other growers may in addition use the cultivator once or twice.

TABLE VII.—*Cultivation practices on the 38 farms studied in Payette Valley, Idaho.*

Implement.	Per cent of number using.	Number clean.	Number mulch crop.	Man-hours.	Horse-hours.	Acres per day.	Cost per acre.	Width of implement.
								Feet.
Plow	31.58	8	4	7.23	14.46	1.38	$3.61	1
Disk	57.89	12	10	1.77	3.54	5.65	.89	7
Spring-tooth harrow	15.79	4	2	1.81	3.62	5.52	.91	7
Spike-tooth harrow	39.47	11	4	.96	1.92	10.42	.48	9
Crease shovel plow	36.84	7	7	1.64	3.28	6.10	.82	.....
Crease (6-foot cultivator)	10.52	3	1	.92	1.84	10.87	.46	.....
Float	10.52	4	.....	1.24	2.48	8.06	.62	8 by 14
Weeder	5.26	1	1	.96	1.92	10.42	.48	8
Cultivator	5.26	2	.....	1.00	2.00	10.00	.50	8
Corrugator	5.26	.....	2	1.50	3.00	6.67	.75	.....
Alfalfa ditcher	2.63	.....	1	1.88	3.76	5.32	.94	.....
Mormon ditcher	2.63	.....	1	2.00	4.00	5.00	1.00	.....
Riller	21.05	4	4	1.01	2.02	9.90	.51	.....

It can not be said that the average grower practices intensive cultivation as it is practiced in some commercial districts. The water supply has been adequate to supplement the normal rainfall, so that there has been no pressing need of conserving moisture. Some growers cultivate their orchards between irrigations, particularly after the first. Most orchardists, however, do not cultivate the land after the first irrigation rills have been laid out. For all orchards under all systems of management the average total annual cost for cultivation, including plowing, is $5.52 per acre, or $0.0164 per box. (See Table VIII.)

TABLE VIII.—*Total of all cultivation costs per acre and per box on farms studied in Payette Valley, Idaho.*

	Clean cultural.		Mulch crop.		All orchards.	
	Cost per acre.	Cost per box.	Cost per acre.	Cost per box.	Cost per acre.	Cost per box.
Plowing	$1.44	$0.0043	$0.42	$0.0013	$0.85	$0.0025
Other cultivation	7.93	.0236	2.30	.0068	4.67	.0139
All cultivation	9.37	.0279	2.72	.0081	5.52	.0164

MULCH CROPS.

The use of mulch crops has become general within the last few years. Only a few orchardists take off more than one crop of hay, and many use the crop entirely for pasture or leave it on the ground, although many others make three cuttings, which may be taken off or left on the ground as a mulch. The most common method of handling mulch crops in this region, however, is to allow hogs to pasture off the crop. In this way the soil is enriched and at the same time the wormy and inferior fruit on the ground is utilized for feed.

Where mulch crops are grown, it is the practice to go on the land with a disk in the latter part of March or the first of April. The

orchardists may follow this with some other cultivation tool, such as the spring or spike tooth harrow. Following this, however, there is no further treatment of the soil aside from the rilling for irrigation. A few men plow under their mulch crops as an annual practice, but most of them leave them in for several years, although the growers say it is the intention to turn under and resow the mulch crop at intervals of from three to four years.

The kinds of mulch crops used vary somewhat from those in other regions. Alfalfa seems to be the most popular and is used largely for pasture. There are many orchards in bluegrass, which also is

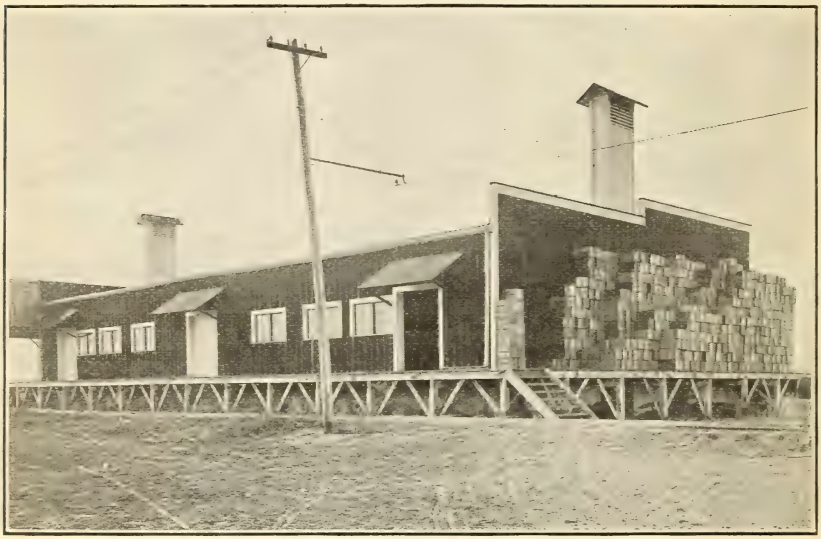

FIG. 8.—A large packing shed of a fruit grower near Boise.

used as a pasture. This has been down in some cases 10 or 12 years. The older orchards, which show the greatest amount of neglect, are the ones which are in mulch crops, or, more properly speaking, which have been in sod for a number of years. Such an orchard really can not be said to be under the mulch-crop system.

These mulch-crop orchards are often irrigated by means of flooding, although about half are irrigated by means of rills. Generally the pastured orchards are flooded, while the better-cared-for orchards are rilled.

It is found that 7 of the 22 men who use some form of mulch crop have their orchards in clover, and 9 have them in alfalfa. Four pasture their orchards in addition to taking the hay off, while seven make a practice of pasturing the orchard and not taking off any hay. There is a net credit of $7.40 per acre for hay and pasture, or a credit per box of $0.022, for the 22 growers who use some kind of mulch crop. (See Table IX.)

TABLE IX.—*Credit derived from mulch crop on farms studied in Payette Valley, Idaho.*

Number of records.	Per acre.					Net credit per box.
	Cost of harvesting.	Hay credit.	Pasture credit.	Total credit.	Net credit.	
22	$1.87	$0.21	$3.06	$9.27	$7.40	$0.022

IRRIGATION.

In the Fruitland district there are two important irrigation projects. One is the Noble ditch, watering about 6,000 acres, with an average maintenance fee of but little over $1 per acre per year. This was organized in 1894 and receives its water from the Payette River. The higher land in the south Payette district is watered by the Farmers' Cooperative ditch, which is a large project embracing about 13,000 acres. It taps the Payette River at Emmett, farther up the stream than the opening of the Noble ditch. The maintenance charges for this ditch are from $1.50 to $2 per acre per year; the water from it is turned on about the first of May.

In the region north of Payette, or the Woodspur section, are found districts known, respectively, as the Lower Payette district and Payette Heights. The former comprises the greater acreage. The Payette ditch furnishes water at a low maintenance cost which will average about $0.50 per acre per year. In order to water the Payette Heights, it has been necessary in many cases to install pumping plants to lift the water up to the higher lands. This makes the cost of irrigating very much higher than that on lands watered by a gravity flow. In many cases it is $6 to $7 per acre per year for the water delivered on the land. For the most part the water is conducted in open ditches or flumes, and piping systems are not common. It is necessary to irrigate all orchards in this region, as the annual rainfall is not sufficient to sustain the trees. On an average 4.7 irrigations are made annually on the 38 orchards studied in the valley, the mulch-crop orchardists averaging 5.18 irrigations, while the clean cultural average 4.06. In the case of the clean-cultivated orchards, the first irrigation usually is made during the latter part of May or the first of June, and the last during the latter part of August. These irrigations are made at regular intervals during this period. (See Table X.)

TABLE X.—*Average number of irrigations and practices for farms studied in Payette Valley, Idaho.*

	Number of irrigations.	Average man hours per irrigation.	Total man hours for all irrigations.	Cost per acre per irrigation.	Cost per acre for all irrigations.	Cost per box for all irrigations.
Clean cultural	4.06	2.434	9.88	$0.486	$1.98	$0.0059
Mulch crop	5.18	1.725	8.94	.345	1.79	.0053
All records	4.71	1.983	9.34	.398	1.87	.0055

The rilling for the irrigation is done either by shovel cultivators, single plows, corrugators, or homemade rillers. In irrigating the mulch-crop orchards the system of flooding is used to a great extent. In flooding the time is considerably reduced, for this method aims to cover the whole orchard by allowing the water to follow its own course. The topography of the land and type of soil will determine the method of applying the water.

Where mulch-crop orchards are rilled, a common tool used is a "corrugator," consisting of two metal shovellike attachments with a substantial iron frame. Six rills usually are made per tree row. As a rule, the date for the first irrigation is earlier on mulch crop than on the clean-cultivated orchards, the first watering usually being made during the first two weeks in May and seldom later than the last of this month. In a few cases men flood their orchards in the fall.

The average time for irrigating the mulch-crop orchards is 1.72 man-hours, with an acre cost of $0.345, or for the 5.18 irrigations there is a charge of 8.94 man-hours and a cost of $1.79 per acre, or $0.0053 per box for labor.

Considering all records, irrigation costs $1.87 per acre or $0.0055 per box. The average annual water tax is $1.28 per acre, or $0.0038 per box, and the total for labor and water tax is $3.15 per acre, or $0.0093 per box.

SPRAYING.

The spraying program of the Payette district is comparatively uniform. All growers from whom records were taken make one dormant lime-sulphur spray and one calyx arsenate-of-lead spray. They average 2.09 other arsenate-of-lead sprays, making an average of 4.09 sprays for the season.

All the growers except three own their own spray rigs, which generally are of standard make, although there are a few assembled rigs. When the spray outfit is hired, the usual price is $1 per hour for man, team, and outfit. The grower's average investment in the spray outfit for those owning them is $360. The spray-rig engine varies from 2 to 3½ horsepower, the majority being 2½. The 200-gallon tank is the one most commonly used. There are very few men who use spray towers on their rigs, though in the older orchards spray towers are an advantage.

It is found that the life of the average spray rig is approximately 9½ years, and that the depreciation amounts to $37.80 annually. This, added to an annual upkeep of $16 and an annual interest charge of $28.80 on the original investment, makes an annual charge of $82.60 per spray rig.

Approximately 20 acres of fruit are sprayed annually by each spray rig. This would then give an acre charge of $4.13 for depreciation,

upkeep, and interest, together with $0.74 for oil and gasoline, making a total annual charge of $4.87 per acre for the use of the spray rig and engine. Those who hire their spraying done pay for the rig itself about $0.50 per hour, wages of man and team making up the remainder of the charge of $1 per hour. Allowing the same number of spray hours per acre for those who hire the spraying done, there would then be an annual charge of $5.73. In reality, however, there are usually fewer hours spent per acre for those who hire than for those who do their own spraying. There is an average of 10 spray-rig hours an acre for those who hire the spraying done, thus making the annual cost $5 per acre, or $0.13 more per acre than for those who own their spray rig.

Most spray rigs have two leads of 50-foot rubber hose and use an 8 to 10 foot spray rod. The pressure varies from 125 to 275 pounds, but usually is about 200 pounds.

There are many orchard pests and diseases which the grower finds it necessary to control. The most important pests are the San Jose scale and the codling moth. These made their appearance in the early years of the commercial apple industry in this region. There are others which require less attention and which the growers in this section have had little trouble in combating as yet, such as the green aphis, woolly aphis, oyster-shell bark louse, blister mite, etc.

TABLE XI.—*Payette spraying practices and costs (38 records).*

Kind of spray.	Average number of sprays.	Per acre.		Acres per 10 hours.	Gallons per acre.	Gallons per tree.	Per acre.			Total cost per box.	Strength of spray.
		Man-hours.	Horse-hours.				Labor cost.	Material cost.	Total cost.		
Lime-sulphur dormant spray.	1.00	8.24	6.05	3.31	388.56	6.14	$2.56	$7.29	$9.85	$0.0292	1 to 9.
Calyx or first lead arsenate spray.	1.00	7.51	5.42	3.69	378.09	5.97	2.31	2.00	4.31	.0128	2 lbs. lead to 50 gals. water.
Other lead-arsenate sprays.	2.09	15.96	11.45	3.65	776.49	12.27	4.91	4.14	9.05	.0269	2 lbs. lead to 50 gals. water.
Total all sprays.	4.09	31.71	22.92	3.57	1,543.14	24.38	9.78	13.43	23.21	.0689	

The more important apple diseases are blight, mildew, and apple scab. Blight is by far the most serious, and as yet there is no effective remedy other than cutting out the infected parts 6 or 7 inches below the infection, using great care to disinfect the tools with corrosive sublimate. Mildew and scab are present and have caused considerable trouble. The apple scab made its first appearance in Idaho in Latah County, in 1897, being noticed at a much later date in Canyon County. The growers considered in these records, however, had not made a practice of spraying to prevent either of these diseases up to the time these data were taken. It was found that all growers thoroughly

believe in the application of the first spray, made for the San Jose scale. Heavy losses have been suffered in the past from this pest, and now a great deal of attention is given to its control. When all growers spray with a dormant lime-sulphur spray of a strength varying from 1 to 8 to 1 to 11, it apparently holds the scale in check, so that little damage to the fruit is experienced. Applications of this dormant lime-sulphur spray are made every year, usually during the latter part of March or the first of April, after the buds begin to swell.

The usual spraying crew consists of three men and two horses, two men using the two leads of hose, and the third man driving the team.

The average crew will spray 3.31 acres in 10 hours, applying 388.56 gallons per acre, or 6.14 gallons per tree. The labor cost is $2.56 per acre, and the material cost $7.29, making a total cost of $9.85 per acre, or $0.0292 per box. (See Table XI.)

The first lead-arsenate spray of the season, known as the calyx spray, is made for the control of the codling moth. This application is made when about 80 per cent of the petals have fallen, which is usually the first or second week in May. It ordinarily consists of lead arsenate and water, paste lead arsenate being used at the average strength of 8 pounds to a 200-gallon tank of water, or dry lead arsenate 4 pounds to a 200-gallon tank of water. Lime-sulphur or atomic sulphur, sometimes used in this spray for scab prevention, is not as yet used by any of these growers. In applying this spray the average crew will spray 3.69 acres in 10 hours, applying 378.09 gallons per acre, or 5.97 gallons per tree, with a labor cost of $2.31 and a material cost of $2.00, or a total cost of $4.31 per acre.

The second spray for the control of the codling moth usually is made about three weeks later than the first and is spoken of as the "three weeks' spray." In severe cases, however, a spray is made 10 days after the time the petals fall, using the same strength of lead as in the case of the calyx spray. The third, and usually the last, application is made during the last week of July. Where four applications are made, the second usually follows the calyx in about 10 days, the third about the first of June, and the fourth the latter part of July. As a rule, however, either the second or fourth spray is omitted, making a total of only three applications of lead for the control of the codling moth larvæ. For these lead sprays other than the calyx spray, the average crew will spray 3.65 acres per day, applying about 1,350 gallons in this time.

Considering all sprays, the total labor cost for spraying is $9.78, while the total material cost is $13.43, making a total of all costs for labor and material of $23.21 per acre, or $0.0689 per box. The cost of the spray rig itself, including the gasoline, upkeep, etc., is not included here, but is included under the annual equipment charge to be found under the fixed costs.

In 1915 and 1916 atomic sulphur was used in some other sprays, than the calyx and doubtless will be used more generally in the future for the control of apple diseases, particularly mildew.

MISCELLANEOUS.

There are some items which do not appear in the regular labor column. These are classed as miscellaneous items. The principal of these are cutting blight, cleaning laterals and waste ditches, mowing weeds, hoeing about the orchard, and doctoring trees, and there are many other small items which appear on but a few farm reports. In this district miscellaneous labor is made up entirely of man labor, the cost of which is $1.41 per acre, or $0.0042 per box.

HANDLING THE CROP.

The cost of handling the crop makes up 60.95 per cent of the total annual net labor cost of production, or 26.30 per cent of the total of all net costs. The items which go to make up this handling are: Picking, orchard foreman, all packing-house labor, including sorting, packing, nailing, stamping, waiting, etc., and any other labor about the packing house, such as packing foreman. The hauling, which is a part of the handling costs, includes hauling shooks from the station, hauling empty boxes to and full boxes from the orchard, and hauling packed boxes to the association or station. Before discussing these items it should be stated that a large number of men in this region pick their fruit and haul it to the association or warehouse where it is packed, the grower being charged a price which varies with different branch packing houses of the central association. At the time of this study, 14, or practically 37 per cent of the 38 growers, did not pack their own fruit, but took it to these association packing houses, where it was sorted, sized, and packed.

PICKING.

Picking in this region is done very largely by day labor at the rate of $2 per 10-hour day, although sometimes growers contract with men to pick at $0.04 per box. The picking season usually begins in early September and lasts until late in October. The first commercial variety picked in this region is the Jonathan. Growers ordinarily begin to pick these about September 10, or sometimes earlier where apples are intended for foreign trade. Two or more pickings often are made for such varieties as the Jonathan and Rome Beauty. These apples are picked for color, and as all the apples on the tree are not colored evenly at one time, it is desirable to make more than one picking. Other varieties usually are taken off at one picking. On this account the grower can pick more boxes per day of such varieties as Ben Davis than he can of Jonathan.

All picking is done by hand. The ordinary stepladder, varying in length but usually light and easily handled, is commonly used.

A canvas picking bag is used by nearly all growers. Some of the growers use orchard boxes, in which the apples are hauled from the orchard to the packing house. These boxes are larger and heavier than the ordinary apple box and are commonly called lug boxes. However, as in other Northwest sections, these growers usually handle their apples in the ordinary packing boxes which have been made up and hauled into the orchard at convenient places for the pickers. As these same boxes are used for packing, more care is taken in handling them than in handling the lug boxes.

It is found that the average picker will pick 67 loose boxes per day, or enough to make 44 packed boxes. The average picking crew consists of from three to four men. On the farms studied, with a yield of 337 boxes per acre, it costs $15.53 per acre, or $0.0461 per box for picking. (See Table XIII.) The picking time and cost are affected by yield, size of orchard, variety of apple, weather conditions, uniformity of the fruit, and many other factors. Owing to the limited number of orchards from which data were obtained, no definite conclusions could be reached as to the relative influence of these different factors on the cost.

There are a few men with large orchards who employ an orchard foreman to superintend the pickers. On the total labor cost this foreman labor is combined with the picking labor, but influences it very little, the cost, including the foreman, being $0. 0465 per box. This is because there were only two orchards which used an orchard foreman who did not also act as a picker.

The picking labor, including the orchard foreman, makes up 15.16 per cent of the total net labor cost and 6.54 per cent of the total annual net cost of production.

HAULING.

Hauling costs include hauling shooks, hauling the loose boxes to and from the orchard, and hauling to the station or association. Twenty-four men haul shooks, the others handling their fruit through an association from which they obtain their made-up boxes. In the case of these 24 orchardists, one man and team haul 471 shooks per load a distance of 1.24 miles at a cost of $0.87 per acre, or $0.0026 per box. (See Table XII.) After these shooks are hauled, they are made up on the ranch at an average cost of $0.85 per hundred. This cost is included under made-up box cost in material and fixed costs. All growers haul empty boxes to the orchard. Fourteen of these haul from the association packing house, while 24 haul from their own packing house on the ranch. The cost of hauling

these loose boxes to the orchard is $0.006 per box. There are 24 growers who haul full loose boxes into the packing house, the other 14 hauling direct to the warehouse or association. An orchard truck is generally used by the 24 who haul to their own packing houses, hauling a load of 53 boxes at a cost of $3.96 per acre, or $0.0121 per box.

All growers haul full boxes of fruit from the ranch to the association or station. Twenty-four of these haul packed boxes, while 14 haul boxes to be packed at the association. The average cost is $5.16 per acre, or $0.0153 per box.

TABLE XII.—*Average cost for hauling where a crew of one man and two horses is used.*

	Number practicing.	Boxes per load.	Number of miles	Cost.		
				Per acre.	Per box.	Per box per mile.
Haul shooks	24	471	1.24	$0.87	$0.0026	$0.0021
Haul empty out	38	99	.....	2.01	.0060	.....
Haul full in	24	53	.....	3.96	.0121	.....
Haul to station	38	72	1.32	5.16	.0153	.0116

When all hauling costs are considered they are found to amount to $0.0306 per box. This is relatively low, as compared to the cost in some regions, owing to the fact that most orchards here are in the immediate vicinity of the shipping stations and also to the fact that hauling the full boxes from the orchard to the rancher's packing shed is done away with in the case of the 14 orchardists who haul their loose boxes direct to the association packing house.

PACKING-HOUSE LABOR.

The principal items of packing-house labor are the sorting and packing. As 14 of these men have their apples packed by the association, this discussion applies only to the 24 growers who do their own packing. All these 24 growers have sorters for their fruit apart from the packers.

SORTING.

Sorting in this region is nearly all done by hand, women being largely employed for this work. As yet very few mechanical sizers have been brought into the valley, except for use in association packing houses. The apples are usually sorted into three grades; extra fancy, fancy, and C grade. The apples that are used for cider nearly all pass the sorters; that is to say, these apples are taken out by the sorters from the boxes of picked fruit. The labor of sorting depends on the variety of fruit and its relative freedom from insect or fungus injury. The sorters usually do not size the fruit, but only sort it into the grades, the packer sizing his own fruit.

The average sorter when doing nothing else will sort from 75 to 80 packed boxes in 10 hours, or about 125 loose boxes. The sorting cost when the 24 orchards are considered is $8.84 per acre, or $0.0266 per box.

TABLE XIII.—*Average cost for handling other than hauling (38 records).*

Item.	Number of orchards practicing.	Boxes in 10 hours.	Cost per acre.	Cost per box.	Number in crew.
Picking	38	43.38	$15.53	$0.0461	3.21
Supervision by picking foreman	2	289.86	2.62	.0069	1.00
Sorting	24	75.19	8.84	.0266	3.54
Packing	24	55.75	16.62	.0500	5.63
Nailing and waiting	7	170.94	3.35	.0117	1.00
Nailing	17	312.50	2.25	.0064	1.00
Waiting	12	259.74	2.39	.0077	1.00
Supervision by packing foreman	11	338.98	2.17	.0059	1.00
Other packing labor	9	196.08	3.58	.0102	1.22

PACKING.

The packing wage per box is ordinarily $0.05 for sorted apples. Much of the packing is done by young women. In a few cases packers are hired by the day.

Provision for packing-house accommodations has been made by nearly every grower. (See fig. 8.) Sometimes barns or sheds are used for this purpose during the harvesting season. In a few cases complete and well-arranged packing sheds have been built at a cost of several hundred dollars. The average packing shed, however, does not represent a very great outlay of money. Often it is but a shed or barn temporarily converted to this purpose.

The packers have the apples before them sorted into the three different grades, which they size as they pack. The experienced packer can tell very readily by looking at the apple to what size it belongs. Thus the average packer has three or four boxes before him in which to put apples of the same grade but different sizes. The packer is usually required only to wrap and pack the apples. In some cases, however, the packer also lines the boxes, although this is often the work of a waiter or extra helper in the packing house.

The average number of packed boxes per day in the case of these 24 men is 55.7 per packer.

NAILING, ETC.

Seventeen of these 24 men make a practice of using one man for nailing alone, while seven combine nailing and waiting. For those who nail it was found that one man will do 312 boxes in 10 hours at a cost of $0.0064 per box, while for those who nail and wait it is found that the average man will do 171 boxes in 10 hours at a cost of $0.0117 per box.

Twelve of the packers have a waiter whose business it is to wait on the sorters and packers. This waiter will handle the boxes and wait on a crew putting out 260 boxes per day. The cost per box for this labor is $0.0077. Nearly half of the men who pack their own apples either employ a packing-house foreman, or the owner himself acts in this capacity in addition to doing other packing-house labor. In these cases the packing-house foreman is employed separately from any packer or sorter. The cost per box for such men as have a foreman is $0.0059, figured at the regular labor rate of $0.20 per hour, although if the foreman is hired he is frequently paid at a higher rate. Many growers use still other packing-house labor. Such labor usually includes the man who helps truck the boxes and does various other things that are often done by waiters.

The total packing-house labor cost, including those who have their packing done at the association, is $41.64 per acre, or $0.1236 per box.

Both the associations and the growers generally use the Northwest diagonal pack. The extra fancy and fancy grades and often the C grades are wrapped. C grades, and sometimes fancy apples, in poor-price years, are packed but not wrapped. The distributors make a practice of wrapping all three grades. The association charge in such cases includes not only labor, but the box, paper, nails, etc., also the cost of handling the box, together with an inspection fee and sinking fund. However, in this study of costs only the actual packing and box costs are considered. Inspection, sinking fund, overhead expenses, etc., are items which are not taken into consideration in any of this cost-production work, since they are factors which ordinarily enter into the cost of marketing after the apples are delivered at the station.

All handling labor cost has now been discussed. If to the packing-house labor of $0.1236 per box is added the cost of made-up box, including paper, nails, etc. ($0.1585), there is a total material and labor cost per box of $0.2821 within the packing house. If to this are added all other handling labor costs, there is a total for handling, including labor and material, of $0.3612 per box, or after the culls are credited, it is reduced to $0.3455 per box as a net labor and material cost.

CULLS AND CIDER APPLES.

Many growers sell a few tons of cider or drier apples each year. These are known as the "cull apples," and may come either from the packing shed or be picked up from the ground in the orchard. In the Payette region, however, very few growers pick up windfalls and sell them as cider apples. Most of the apples used for cider in this section

are separated from the better grades by the sorters in the packing house, as the price received hardly would warrant the labor of picking up the apples in the orchard. The price per ton varies, but is usually from $5 to $6, delivered at the cider factory. At present there is not a large enough demand for cider apples to justify handling all those available in the valley. A great many growers do not sell their cull apples, but feed them to hogs, valuing them at from $3 to $4 per ton as hog feed.

The credit per acre derived from culls averages $5.40 for the orchards under the clean-cultural system and $5.22 for those under the mulch-crop system. For all orchards there was a credit of $5.29 per acre, leaving a net credit of $4.61 after the labor cost of picking up and hauling culls is taken out. By crediting this, the cost of handling labor is reduced from $0.2007 per box to $0.1870 per box.

TOTAL LABOR COSTS.

The total of all labor costs after crediting the maintenance labor with the hay or pasture credit and the handling labor with the cull credit, is $103.40 per acre, or $0.3068 per box. (See Table XIV.) This is 43.14 per cent of the total annual net cost of production. The net maintenance labor costs $40.38 per acre, or $0.1198 per box, making up 16.84 per cent of the total annual net cost, while the net handling labor amounts to $63.02 per acre, or $0.1870 per box, and makes up 26.30 per cent of the total annual net production cost.

As may be seen from the labor table, the costs of thinning and pruning are the largest maintenance costs. They make up 18.32 per cent of the total net labor cost. These total labor costs are for an average of all the bearing orchards considered and are on the basis of a yield of 337 boxes per acre. The table is self-explanatory and shows the difference between the clean-cultural and mulch-crop orchards, there being a difference in the net maintenance costs of $0.0229 per box, this cost being greater in the case of the clean-cultural orchards. However, for all net labor the cost per box is practically the same in both the clean-cultural and the mulch-crop orchards, being $0.3085 in the case of the former and $0.3054 in the case of the latter.

TABLE XIV.—*Summary table of all labor costs, 38 farms in Payette Valley, Idaho.*

Item.	Clean-cultural management (16 records; 336 boxes per record).			Mulch-crop management (22 records; 338 boxes per record).			Combined management (38 records; 337 boxes per record).			
	Cost per acre.	Cost per box.	Per cent of total net cost.	Cost per acre.	Cost per box.	Per cent of total net cost.	Cost per acre.	Cost per box.	Per cent of total net labor cost.	Per cent of total net cost.
Manuring	$1.74	$0.0052	0.74	$1.94	$0.0057	0.79	$1.85	$0.0055	1.79	0.77
Pruning	8.47	.0252	3.58	10.22	.0302	4.22	9.48	.0281	9.16	3.95
Disposal of brush	3.59	.0107	1.52	3.34	.0099	1.38	3.45	.0103	3.36	1.45
Plowing	1.44	.0043	.61	.42	.0013	.18	.85	.0025	.81	.35
Cultivating	7.93	.0236	3.35	2.30	.0068	.95	4.67	.0139	4.53	1.96
Irrigating	1.98	.0059	.84	1.79	.0053	.74	1.87	.0055	1.79	.78
Thinning	8.41	.0250	3.56	10.25	.0303	4.23	9.47	.0281	9.16	3.95
Propping	1.81	.0054	.77	2.87	.0085	1.19	2.42	.0072	2.35	1.01
Miscellaneous	1.23	.0037	.53	1.54	.0046	.64	1.41	.0042	1.37	.59
Lime-sulphur spray	2.44	.0072	1.02	2.64	.0078	1.09	2.56	.0076	2.48	1.06
Lead sprays	6.38	.0190	2.70	7.84	.0232	3.24	7.22	.0214	6.98	3.01
Sowing mulch crop				.01						
Harvesting mulch crop				1.87	.0055	.77	1.08	.0032	1.04	.45
Total labor cost previous to handling	45.42	.1352	19.22	47.03	.1391	19.42	46.33	.1375	44.82	19.33
Hay credit				9.27	.0274	3.82	5.37	.0160	5.22	2.25
Wood credit	.69	.0021	.30	.50	.0015	.21	.58	.0017	.55	.24
Total credit	.69	.0021	.30	9.77	.0289	4.03	5.95	.0177	5.77	2.49
Total net labor cost previous to handling	44.73	.1331	18.92	37.26	.1102	15.39	40.38	.1198	39.05	16.84
Hauling shooks	.68	.0020	.28	.46	.0014	.20	.55	.0016	.52	.23
Hauling loose boxes to and from orchard	5.27	.0157	2.23	4.13	.0122	1.70	4.61	.0137	4.46	1.93
Picking and orchard foreman	15.45	.0460	6.54	15.82	.0468	6.54	15.67	.0465	15.16	6.54
All packing-house labor	37.39	.1113	15.82	44.73	.1323	18.47	41.64	.1236	40.29	17.38
Hauling to station or association	4.60	.0137	1.95	5.56	.0165	2.30	5.16	.0153	4.99	2.15
Picking up and hauling culls	.94	.0028	.40	.50	.0015	.21	.68	.0020	.65	.28
Total labor cost for handling	64.33	.1915	27.22	71.20	.2107	29.42	68.31	.2027	66.07	28.51
Credit for culls	5.40	.0161	2.29	5.22	.0155	2.17	5.29	.0157	5.12	2.21
Total net labor cost for handling	58.93	.1754	24.93	65.98	.1952	27.25	63.02	.1870	60.95	26.30
Total net cost of all labor	103.66	.3085	43.85	103.24	.3054	42.64	103.40	.3068	100.00	43.14

MATERIAL AND FIXED COSTS.

Costs other than labor, including the material and fixed cost, amount to $136.25 per acre, or 56.86 per cent of the total annual net cost of production. (See Table XV.) The material costs are made up of manure, spray materials (including lime-sulphur, lead, and other spray materials used), seed, and the cost of made-up box, including paper and nails. This material cost amounts to $72.94 per acre, or $0.2164 per box. It makes up 30.43 per cent of the total annual net cost of production. There was no appreciable difference between the material costs of the clean-cultural and mulch-crop orchards, the cost being $0.2148 per box in the case of the clean-cultural and $0.2176 per box in the case of the mulch-crop orchards. The cost of made-up

box is the largest single item of the material cost, amounting to $0.1585 per box. This cost is made up as follows:

Cost of box shook	$0.1100
Cost to make up	.0085
Cost of wrapping paper	.0275
Nails	.0036
Cost of cardboard	.0044
Cost of lining paper	.0045
Total	.1585

The spray material is the second largest material cost, the lime and sulphur costing $7.29 per acre and the lead amounting to $6.14 per acre, making a total spray-material cost of $13.43 per acre, or a box cost of $0.0398. This spray material makes up 9.84 per cent of the total material and fixed cost and 5.60 per cent of the total annual net cost of production. A commercial brand of lime and sulphur is used. The ordinary arsenate of lead paste is generally used, although a few growers use the dry lead.

TABLE XV.—*Summary table of material and fixed costs, 38 farms in Payette Valley, Idaho.*

Item.	Clean-cultural management (16 records; 336 boxes per record).			Mulch-crop management (22 records; 338 boxes per record).			Combined management (38 records; 337 boxes per record).			
	Charge per acre.	Charge per box.	Per cent of total net cost.	Charge per acre.	Charge per box.	Per cent of total net cost.	Charge per acre.	Charge per box.	Per cent of total material and fixed cost.	Per cent of total net cost.
Manure	$6.17	$0.0184	2.61	$5.92	$0.0175	2.44	$6.03	$0.0179	4.43	2.51
Lime and sulphur	6.98	.0208	2.96	7.51	.0222	3.10	7.29	.0216	5.34	3.04
Arsenate of lead (first spray)	1.94	.0058	.82	2.04	.0060	.84	2.00	.0059	1.46	.83
Other spray material	3.81	.0113	1.61	4.39	.0130	1.81	4.14	.0123	3.04	1.73
Seed				.12	.0004	.06	.07	.0002	.05	.03
Cost of made-up box	53.26	.1585	22.53	53.57	.1585	22.13	53.41	.1585	39.20	22.29
Total material cost	72.16	.2148	30.53	73.55	.2176	30.38	72.94	.2164	53.52	30.43
Interest charge	46.50	.1384	19.67	50.91	.1506	21.03	49.05	.1456	36.01	20.48
Apple-building charge	2.87	.0085	1.21	3.13	.0093	1.30	3.02	.0090	2.23	1.27
Equipment charge	4.24	.0126	1.79	5.55	.0164	2.29	4.99	.0148	3.66	2.08
Sprayer hire				.70	.0021	.29	.41	.0012	.30	.17
Tax	4.94	.0147	2.09	3.82	.0113	1.58	4.29	.0127	3.14	1.79
Insurance	.26	.0008	.11	.28	.0008	.11	.27	.0008	.20	.11
Water rent	1.78	.0053	.75	.91	.0027	.38	1.28	.0038	.94	.53
Total fixed cost	60.59	.1803	25.62	65.30	.1932	26.98	63.31	.1879	46.48	26.43
Total material and fixed costs	132.75	.3951	56.15	138.85	.4108	57.36	136.25	.4043	100.00	56.86

The third largest item of material cost is the manure. For all orchards an average of 4.02 tons per acre is applied annually, at a material cost of $6.03 and a box charge of $0.0179. This makes up

4.43 per cent of the total material and fixed cost and 2.51 per cent of the total annual net cost.

The other item of material cost is the seed, which amounts to but $0.07 annual charge per acre over all orchards and $0.12 per acre for those under mulch-crop orchards. This charge is for alfalfa, bluegrass, or clover seed, which is sown only occasionally.

Under fixed costs are included such items as interest on apple orchard, the apple-building charge, equipment (including spray-rig hire), taxes, insurance,and water rent. The fixed costs amount to $63.31 per acre annually, or $0.1879 per box. They make up 46.48 per cent of the material and fixed cost and 26.43 per cent of the total annual net cost of production.

The interest charge ($49.05 per acre, or $0.1456 per box) is larger than all other items combined, being 20.48 per cent of the annual net cost of production. The equipment charge is figured at the rate of 25 per cent annual charge on equipment investment. The greatest item of equipment investment is the spray rig, which practically all growers own and on which there is ordinarily a large depreciation. The fact that the depreciation charge appears low is due to the fact that all equipment is figured at present value, while under the discussion of spray rigs the depreciation and upkeep is figured on the original investment. The annual equipment charge per acre is $5.40, or $0.0160 per box, being 3.96 per cent of the total material and fixed cost, or 2.25 per cent of the total annual net cost of production. The spray rig makes up over 75 per cent of this annual equipment charge.

The material cost in the case of Payette is about the same per box as found in other Northwest apple regions. However, in the case of the fixed cost there is a much lower charge per acre and per box than in most other Northwest regions, due to the fact that the average investment in land is much lower. The equipment charge in the Payette region is also somewhat less than in more intensive and specialized regions, for the farms are larger and the tools, with the exception of the spray rig, are used for many other purposes than for orchard operations.

The total material and fixed cost, amounting to $0.4043 per box, of which 53.52 per cent is for material and 46.48 per cent for fixed cost, represents all costs other than labor.

SUMMARY OF ALL COSTS CONSIDERED.

When all items entering into the annual net cost of production of apples on the 38 farms studied are considered, there is found to be a cost of $0.7111 per box for all records, for clean-cultural orchards $0.7036, and for mulch-crop orchards $0.7162. It is thus found that

it costs slightly over 1 cent more per box for the mulch-crop than for the clean-cultural orchards. This difference in cost is principally due to the greater fixed costs on the mulch-crop orchards. It will be seen from Table XVI that the percentage of the various costs which go to make up the total cost is nearly the same in both kinds of records.

TABLE XVI.—*Summary of all costs for 38 farms in Payette Valley, Idaho.*

Item.	Clean-cultural management (16 records: 336 boxes per record).			Mulch-crop management (22 records: 338 boxes per record).			Combined management (38 records: 337 boxes per record).		
	Cost per acre.	Cost per box.	Per cent of total net cost.	Cost per acre.	Cost per box.	Per cent of total net cost.	Cost per acre.	Cost per box.	Per cent of total net cost.
Total net cost of labor previous to handling	$44.73	$0.1331	18.92	$37.26	$0.1102	15.39	$40.38	$0.1198	16.84
Total net cost of labor for handling	58.93	.1754	24.93	65.98	.1952	27.25	63.02	.1870	26.30
Total net cost of all labor	103.66	.3085	43.85	103.24	.3054	42.64	103.40	.3068	43.14
Total material cost	72.16	.2148	30.53	73.55	.2176	30.38	72.94	.2164	30.43
Total fixed cost	60.59	.1803	25.62	65.30	.1932	26.98	63.31	.1879	26.43
Total material and fixed costs	132.75	.3951	56.15	138.85	.4108	57.36	136.25	.4043	56.86
Total net cost	236.41	.7036	100.00	242.09	.7162	100.00	239.65	.7111	100.00
Total net cost on the tree	121.35	.3612	51.33	119.41	.3532	49.32	120.20	.3566	50.16
Total net cost of handling [a]	115.06	.3424	48.67	122.68	.3630	50.68	119.45	.3545	49.84

[a] Includes total net cost of labor for handling, cost of made-up boxes, and apple-building charge.

If the material and fixed costs are combined, the cost of the clean-cultural orchards is 56.15 per cent and of the mulch-crop 57.36 per cent of the total annual net cost of production. It is thus apparent that the cost of production varies but little under the two systems of management.

Seventy-one cents per box may be considered a fair figure for the cost of production in Payette Valley under normal prices for labor and material.

FACTORS AFFECTING THE ANNUAL COST OF PRODUCTION.

The principal factors which affect the cost are the same for Payette Valley as for all other apple regions studied thus far. The one which has the greatest effect upon the cost per box is the yield per acre. Table XVII serves to show the cost of production per acre and per box. Orchards having various yields are divided into 10 groups ranging from 122 to 572 boxes per acre in yield. The maintenance cost is found to remain practically the same per acre in the case of the high yields as in the case of the low, but the maintenance cost per box very materially decreases as the yield per acre increases. The handling and material box costs are little influenced by the yield, while the fixed cost, although remaining much the same per acre,

decreases very rapidly per box as the yield increases. This is as might be expected, since these fixed costs refer to those annual charges which have little or nothing to do with the upkeep of the orchard or the harvesting of the fruit.

Other factors affecting the cost are the size of the orchard, the system of orchard management practiced, the amount of credit derived from hay, wood, culls, etc.

In the case of the smaller yields the grower actually lacks considerable of making any interest on his investment. For instance, with a yield of 122 boxes per acre, and assuming that the grower gets $0.80 for all grades of apples, which is much higher than he gets some years, he would lose 11.4 per cent on his investment in bearing apple orchard. However, with the yield of 221 boxes he makes 3.94 per cent, and with the yield of 331 he makes 8.84 per cent. For those orchards that yield 419 he makes 16.64 per cent, and for those that yield 572 he makes 38 per cent. This, it should be remembered, is on the basis of the grower receiving $0.80 f. o. b. for all grades of box apples.

It should be stated in this connection that with the yield as high as 572 boxes, as is sometimes the case in heavy crop years, there is often a smaller profit per box than in years when the crop is light. This is due to the fact that most orchards have a full crop the same year. Thus, when the crop is light, apples are scarce, and the price is correspondingly high. When there is a heavy crop, apples are plentiful and often bring a very low price to the grower.

TABLE XVII.—*Summary table showing effect of yield upon cost (38 records).*

Item.	Groups.				
	150 boxes or less.	151 to 200 boxes.	201 to 250 boxes.	251 to 300 boxes.	301 to 350 boxes.
Average yields (packed boxes)	122	177	221	271	331
Total net maintenance cost per acre	$42.73	$39.84	$39.72	$25.63	$55.85
Total net maintenance cost per box	.3502	.2251	.1797	.0946	.1687
Total net handling cost per acre	19.29	37.76	42.95	49.46	68.72
Total net handling cost per box	.1581	.2133	.1943	.1825	.2076
Total net labor cost per acre	62.02	77.60	82.67	75.09	124.57
Total net labor cost per box	.5084	.4384	.3741	.2771	.3763
Total material cost	47.51	44.84	49.48	64.93	85.62
Total fixed cost	75.74	51.19	52.72	59.54	48.70
Total material and fixed cost per acre	123.25	96.03	102.20	124.47	134.32
Total material and fixed cost per box	1.0102	.5425	.4624	.4593	.4058
Total net cost per acre	185.27	173.63	184.87	199.56	258.89
Total net cost per box	1.5186	.9810	.8365	.7364	.7821

TABLE XVII.—*Summary table showing effect of yield upon cost (38 records)*—Contd.

Item.	Groups.				
	351 to 400 boxes.	401 to 450 boxes.	451 to 500 boxes.	501 to 550 boxes.	551 to 600 boxes.
Average yields (packed boxes)	380	419	494	539	572
Total net maintenance cost per acre	$43.25	$35.36	$34.80	$57.49	$45.09
Total net maintenance cost per box	.1138	.0844	.0704	.1067	.0788
Total net handling cost per acre	64.71	86.12	75.78	110.21	88.70
Total net handling cost per box	.1703	.2055	.1534	.2045	.1551
Total net labor cost per acre	107.96	121.48	110.58	167.70	133.79
Total net labor cost per box	.2841	.2899	.2238	.3111	.2339
Total material cost	75.48	82.61	102.40	105.39	114.83
Total fixed cost	83.58	74.16	57.01	82.35	59.73
Total material and fixed cost per acre	159.06	156.77	159.41	187.74	174.56
Total material and fixed cost per box	.4186	.3742	.3227	.3483	.3052
Total net cost per acre	267.02	278.25	269.99	355.44	308.35
Total net cost per box	.7027	.6641	.5465	.6594	.5391

The material and fixed charges, which make up all costs other than the labor costs, amount to $136.25 per acre, or $0.4043 per box. Material and fixed costs make up 56.86 per cent of the total annual net cost of production, which is $0.7111 per box.

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